

PATENT ABSTRACTS OF JAPAN

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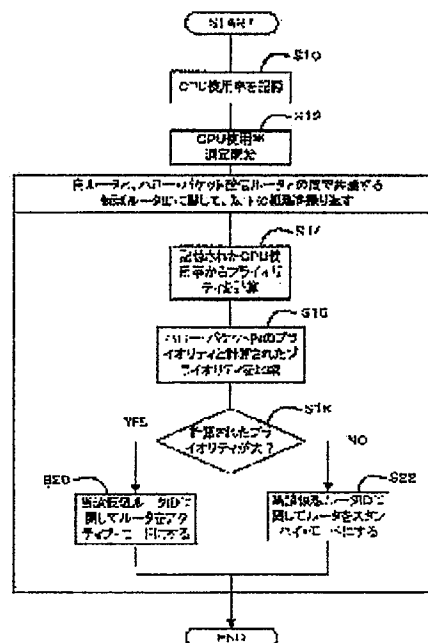
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(54) NETWORK RELAY DEVICE PROVIDED WITH LOAD DISTRIBUTING FUNCTION, LOAD DISTRIBUTING METHOD FOR NETWORK RELAY DEVICE AND PROGRAM

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a load distribution method for a router, by which the processing load of the router is distributed.

SOLUTION: The router has a CPU operating rate measurement means, that measures a CPU operating rate of its own and a priority setting means that dynamically sets priority by using the CPU operating rate. The priority setting means is controlled so as to receive lower priority, when the CPU operating rate is higher; while in the case of a protocol, such as the VRRP(virtual router redundancy protocol), a router with the highest priority is assigned to particular packet processing among a plurality of the routers. Thus, a router group to which the priority, is set as stated above and the protocol above are combined, to enable the router whose CPU operating rate is low to process many packets, so as to assign the processing in a way of distributing the processing load among the routers.



Partial translation of JP2003046539A: paragraphs 0001-0005 (page 3), paragraphs 0027-0028 (pages 4-5), paragraphs 0038-0062 (pages 5-7), and Fig. 6 (page 10)

[0001]

[Field of the Invention]

The present invention relates to a load dispersing method that enables load dispersion in a router using VRRP (Virtual Router Redundancy Protocol), and particularly, it relates to a method of dispersing loads between routers by dynamically changing the priority of each router used in VRRP.

[0002]

[Background Art]

VRRP is a kind of IP (Internet Protocol), conforming to RFC2338, and it allows the existence of backup router in the case of using a router having a static configuration on LAN.

[0003]

There are provided a plurality of passages for transmitting a packet to an intended node or network, and when there exist a plurality of routers corresponding to the plurality of passages on LAN to which the node of the transmitter side is connected, VRRP selects one of the routers, and the packet from the node of the transmitter side is for example transmitted to the intended node via the router.

[0004]

The plurality of routers forms one virtual router and at the node of

the transmitter side, it is handled as a router having one IP address. Accordingly, even when any one of the routers is selected by VRRP, the packet from the node of the transmitter side is transmitted to one IP address.

[0005]

In VRRP, hello packets are exchanged at constant intervals between routers to check whether each router is in a normal state or not, and it is called a health check. Also, the hello packet contains the priority of the router which transmits the hello packet, and each router compares the priority with its own priority, and thereby, it is determined which router is an active router (master router) for processing the packet. That is, a normal router of highest priority is set as an active router in an autonomic fashion, and other routers are standby routers (backup routers).

[0027]

Accordingly, in this case, VRRP exchanges and compares the values of the above-mentioned priority according to the hello packet between router 71 and router 72, and when the value is larger than that of other router, then the router functions as a master router with respect to the corresponding virtual router ID.

[0028]

For example, as to VRID (1), when $PRI(1-1) > PRI(2-1)$, the router that functions as a master router is router 71 with respect to virtual router ID = VRID (1). Also, as to VRID (2), when $PRI(1-2) < PRI(2-2)$, the router that functions as a master router is router 72 with respect to virtual

router ID = VRID (2).

[0038]

Priority setting means 12 has a function of dynamically setting priority by shifting the CPU duty cycle W measured by CPU duty cycle measuring means 11 back to the original level. Priority PRI 1 can be obtained by the following formula 1.

[0039]

$$\text{PRI 1} = \text{PRI 1 (B)} - \text{PRI 1 (H)} \dots (\text{Formula 1})$$

Here, PRI 1 (B) (basic priority) is a value previously set by the manager or the user, and PRI 1 (H) (correction priority) is a value calculated according to the CPU duty cycle W, and it can be obtained by the following formula 2.

[0040]

$$\text{PRI 1 (H)} = K1 * W/100 \dots (\text{Formula 2})$$

And, K1 is a predetermined coefficient. Further, W ranges from 0 to 100 (%), and therefore, W/100 includes a value ranging from 0 to 1.

[0041]

Also, the CPU duty cycle itself represents the rate of use per predetermined time, but in the present case, the largest, smallest or averaged value of these can be selectively used in a specific length of time T. Naturally, it is also possible to represent the CPU duty cycle in accordance with other standard or combination.

[0042]

Further, basic priority PRI 1 (B) and coefficient K1 can be set every router in accordance with the performance or the like of the router. Also, in

one router, different values can be set every virtual router ID.

[0043]

In the first preferred embodiment of the present invention, in order to execute load dispersion of routers, the CPU duty cycle of router is measured, and the load between routers is dispersed in a direction of lowering the duty cycle, that is, in such a manner that router being lower in CPU duty cycle is higher in priority and serves to execute the routing of more packets, and it is also possible to calculate the priority on the basis of the using frequency of other resources of routers, for example, the duty cycle of memory and the I/O data volume of hard disk.

[0044]

Also, it is possible to calculate the priority by combining some of the using frequency of each resource of router.

[0045]

The timing of comparing the priority between routers is desirable to be the timing of receiving hello packet in VRRP (usually one second interval). Accordingly, specific time T for measuring the CPU duty cycle is also allowable to be the timing (that is, one second).

[0046]

However, it can be considered that changing the master router by frequently comparing the priority this way may cause the deterioration of whole performance depending upon the performance of router, and therefore, it is necessary to carefully adjust the measuring timing.

[0047]

Also, it is possible to set the specific time T for measuring CPU duty

cycle to a rather long length of time such as 2 sec. or 5 sec. so that the long-time changing tendency of CPU duty cycle is reflected in the priority.

[0048]

Furthermore, the above-mentioned formulas 1 and 2 show only an example of formula adjusted so that the higher the CPU duty cycle the smaller the priority becomes, and the scope of the present invention is not limited to this. For those skilled in the art, it is possible to work out many other patterns.

[0049]

The operation of router in the first preferred embodiment of the present invention will be specifically described in the following with reference to Fig. 1 and Fig. 6.

[0050]

In the normal condition, when the relation of $PRI(1 \cdot 1) > PRI(2 \cdot 1)$ holds good, with respect to virtual router ID = VRID (1), router 71 is the master router, and router 71 is selected as the default router of host 81 and host 82.

[0051]

Similarly, in case the relation of $PRI(1 \cdot 2) < PRI(2 \cdot 2)$ holds good, in virtual router ID = VRID (2), router 72 is the master router, and router 72 is selected as the default router of host 83 and host 84.

[0052]

In this condition, each host transmits a packet to the corresponding default router as needed, and as a result, the load of router 71 becomes high and the CPU duty cycle becomes W during specific time T (for example, the

smallest value of CPU duty cycle in specific time T is W).

[0053]

From the above-mentioned formulas 1 and 2, the calculation of PRI (1 - 1) results in reduction of the value of priority and in the relation of PRI (1 - 1) < PRI (2 - 1), then with respect to virtual router ID = VRID (1), router 72 is the master router, and the packets from host 81 and host 82 are transmitted via router 72.

[0054]

Consequently, it is possible to avoid the high load status of router 71. Also, in specific time T after lapse of the predetermined time, the CPU duty cycle of router 71 is lowered, and at the same time, as a result of increase in CPU duty cycle of router 72, the relation of PRI (1 - 1) > PRI (2 - 1) again holds good, then the default router of host 81 and host 82 is again set to router 71.

[0055]

Due to such a conventional function of VRRP and the dynamic control of priority, the burden of high-load router is dynamically dispersed to other router, and efficient packet processing can be realized as a whole.

[0056]

The process flow of routers in the first preferred embodiment of the present invention will be described in the following with reference to Fig. 2 and Fig. 3.

[0057]

Fig. 2 shows a process flow started when a certain router receives a hello packet from other router. In the process, the hello packet received

includes the value of priority of the other router, and therefore, the process is desirable to be started at this timing, but it is also possible to start the process at timing other than this.

[0058]

Also, specific time T for measuring CPU duty cycle is supposed to be same as the timing (usually one second) of receiving hello packet in the following description. Naturally, several kinds of CPU duty cycles in a longer length of time can be stored in a side by side fashion by allocating a plurality of memory areas.

[0059]

When a hello packet is received from other router (for example, router 72), the router (for example, router 71), first in step S10, saves CPU duty cycle so far measured, and in step S12, starts the measurement of CPU duty cycle for the next new time T to be used in receiving the next hello packet.

[0060]

After that, the process in step 14 or step S22 is repeated every virtual router ID common between the router and other router. This is because the calculation of priority and the comparison of priority are executed every virtual router ID.

[0061]

In step 14, from the CPU duty cycle saved in step S10, the priority is calculated by using the formula 1 and formula 2. The CPU duty cycle saved in step S10 corresponds to the CPU duty cycle for (time T) ranging from the previous hello packet reception to the present hello packet reception.

[0062]

In step S16, the priority of other router in the hello packet is compared with the priority calculated in step S14. When the calculated priority of the proper router is greater (YES of step S18), the proper router is shifted to active mode with respect to virtual router ID (step S20). In this way, the packet from the host having virtual router ID is handled by the router and properly transmitted.

[Fig. 6]

